PATENT

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UNITED STATES PATENT APPLICATION

FOR

SPANNER WITH PREVENTION OF DISENGAGEMENT OF FASTENERS

OF

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SPANNER WITH PREVENTION OF DISENGAGEMENT OF FASTENERS

CROSS-REFERENCE TO RELATED APPLICATIONS

[001] The present application is a continuation of, and claims priority to, U.S. Patent Application Serial No. 10/295,368, filed November 15, 2002, which is a continuation of U.S. Patent Application Serial No. 09/820,061, filed March 28, 2001, which is a continuation-in-part application of U.S. Patent Application No. 09/599,206, filed on June 22, 2000, now abandoned, the entire disclosures of which are incorporated by reference herein.

BACKGROUND OF THE INVENTION

[002] The present invention relates to a spanner that may prevent disengagement of fasteners during operation.

[003] Fig. 1 of the drawings illustrates a conventional spanner with a box end. When in use, a nut (or bolt head) is held in the box end of the spanner, as shown in Fig. 2. Nevertheless, as shown in Figs. 3 and 4, the nut tends to move out of the box end such that the outer periphery of the nut is apt to be damaged and thus cannot be used anymore. Applicant's U.S. Patent Application No. 09/599,206 proposes an improved spanner for retaining fasteners in place during operation. However, such a spanner cannot be used in a case that the spanner must be passed through, e.g., a nut for driving, e.g., a bolt head to which the nut is engaged when the bolt head is located at a place that is difficult or impossible to access from the other side.

SUMMARY OF THE INVENTION

[004] It is the primary object of the present invention to provide a spanner that may retain fasteners in place during operation.

[005] It is another object of the present invention to provide a spanner that can be passed through, e.g., a nut to drive, e.g., a bolt head to which the nut is engaged when the bolt head is located at a place that is difficult or impossible to access from the other side.

[006] In accordance with one aspect of the invention, a spanner comprises a box end that has an inner periphery consisting of a plurality of wall faces to define a first polygonal receiving space. Each wall face includes a groove defined therein. The grooves of the wall faces

together define a second polygonal receiving space. At least one of the grooves includes a closed first end and an open second end.

[007] In accordance with another aspect of the invention, a spanner comprises a box end and a drive member rotatably mounted in the box end. The drive member comprises an inner periphery consisting of a plurality of wall faces to define a first polygonal receiving space. Each wall face includes a groove defined therein. The grooves of the wall faces together define a second polygonal receiving space. At least one of the grooves includes a closed first end and an open second end.

[008] Each groove is preferably triangular and includes a closed first end and an open second end. The first polygonal receiving space and the second polygonal space are triangular, square, hexagonal, or octagonal. In addition, the first polygonal receiving space may have an angular positional difference of 60° , 45° , 30° , or 22.5° from the second polygonal receiving space.

[009] Other objects, advantages, and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

Brief Description of the Drawings

[0010] Fig. 1 is a partial perspective view of a box end of a conventional spanner.

[0011] Fig. 2 is a partial perspective view illustrating use of the conventional spanner in Fig. 1.

[0012] Fig. 3 is a partial top view of the conventional spanner in Fig. 2.

[0013] Fig. 4 is a partial sectional view taken alone line 4-4 in Fig.

[0014] Fig. *5* is a partial top view of a first embodiment of a box end of a spanner in accordance with the present invention.

[0015] Fig. 6 is a partial perspective view of the box end of the spanner in Fig. 5.

[0016] Fig. 7 is a partial perspective view, partly cutaway, of the box end of the spanner in Fig. *6.*

[0017] Fig. 8 is a partial top view of the box end of the spanner in Fig. *5.*

[0018] Fig. 9 is a sectional view taken along line 9-9 in Fig. 8.

[0019] Fig. 10 is a partial sectional view similar to Fig. 9, wherein the spanner is engaged with the bolt head.

[0020] Fig. 11 is a partial top view of the box end of the spanner, illustrating another use of the spanner.

[0021] Fig. 12 is a partial sectional view taken along line 12-12 of Fig. 11.

[0022] Fig. 13 is a partial top view of a second embodiment of the box end of the spanner in accordance with the present invention.

[0023] Fig. 14 is a partial top view of a third embodiment of the box end of the spanner in accordance with the present invention.

[0024] Fig. 15 is a partial top view of a fourth embodiment of the box end of the spanner in accordance with the present invention.

[0025] Fig. 16 is a partial top view of a fifth embodiment of the box end of the spanner in accordance with the present invention.

[0026] Fig. 17 is a partial top view of a sixth embodiment of the box end of the spanner in accordance with the present invention.

[0027] Fig. 18 is a partial top view of a seventh embodiment of the box end of the spanner in accordance with the present invention.

[0028] Fig. 19 is a partial top view of an eighth embodiment of the box end of the spanner in accordance with the present invention.

[0029] Fig. 20 is a partial top view of a ninth embodiment of the box end of the spanner in accordance with the present invention.

[0030] Fig. 21 is a top view of a tenth embodiment of the box end of the spanner in accordance with the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

[0031] Referring to Figs. 5 through 21 and initially to Figs. 5 through 9, a first embodiment of a spanner 10 in accordance with the present invention generally includes a box end 11 in which a drive member 12 is rotatably mounted. The drive member 12 includes an inner periphery for driving a fastener, such as a nut or bolt head. In this embodiment, the inner periphery of the drive member 12 has six wall faces 13. The spanner 10 may further include a switch piece 17 for changing ratcheting direction for driving fasteners, such as nuts, bolt heads, etc. Namely, the spanner may be a ratchet-type spanner allowing a change in the ratcheting direction. Of course, the spanner may include two box ends or be of any other type having a box end with a structure disclosed in this specification.

[0032] The inner periphery of the drive member 12 defines a receiving space 12a (Fig. 7) having a first open end 14 and a second open end 15. As illustrated in Figs. 5 through 7, each wall face 13 of the drive member 12 includes a triangular groove 16 having a closed first end 161 that is adjacent to the first open end 14 and an open second end 162 (Fig. 7) that is adjacent to the second open end 15. As illustrated in Fig. 5, the six triangular grooves 16 together define a hexagonal receiving space 16a (Fig. 5) that has an angular positional difference of, e.g., 30° from the receiving space 12a defined by the inner periphery of the drive member 12.

[0033] In use, the spanner can be used as a normal spanner in which a nut 30 to be tightened or loosened is received in the receiving space 12a defined by the inner periphery of the drive member 12, as shown in Figs. 8 and 9. Nevertheless, the spanner can be passed through the nut 30 to engage with a bolt head 22 of a bolt 20 to which the nut 30 is engaged, as shown in Fig. 10. Thus, the spanner can be used to drive the bolt head 22. This is particularly advantageous when the bolt head 22 is located at a place that is difficult or impossible to access from the other side (the lower side in Fig. 10).

[0034] In addition, the spanner can be used in a manner that the nut 30 is received in the receiving space 16a defined by the triangular grooves 16, as shown in Figs. 11 and 12. It is noted that the nut 30 bears against the end walls of the first closed ends 161 of the triangular grooves 16 during loosening or tightening. Namely, the nut 30 is stopped by the end walls of the first closed ends 161 of the triangular grooves 16. Accordingly, disengagement of the nut 30 during operation is prevented.

[0035] Fig. 13 illustrates a second embodiment of the box end of the spanner 10, wherein only one of the triangular grooves 16 includes a closed first end 161 and an open second end; i.e., each of the other five triangular grooves 16 has an open first end and a second open end.

[0036] Fig. 14 illustrates a third embodiment of the box end of the spanner 10, wherein the inner periphery of the drive member 12 is triangular and includes three wall faces 13. Each wall face 13 includes a triangular groove 16 having a closed first end 161 and an open second end (not shown). The three triangular grooves 16 together define a triangular receiving space 16b that has an angular positional difference of, e.g., 60° from a triangular receiving space 12b defined by the inner periphery of the drive member 12. Fig. 15 illustrates a fourth embodiment of the box end of the spanner 10 that is modified from the third embodiment of Fig. 14, wherein only one of the triangular grooves 16 includes a closed first end 161 and an open second end;

i.e., each of the other two triangular grooves 16 has an open first end and a second open end. The spanners shown in Figs. 14 and 15 can be used to drive triangular fasteners.

[0037] Fig. 16 illustrates a fifth embodiment of the box end of the spanner 10, wherein the inner periphery of the drive member 12 is square and includes four wall faces 13. Each wall face 13 includes a triangular groove 16 having a closed first end 161 and an open second end (not shown). The four triangular grooves 16 together define a square receiving space 16c that has an angular positional difference of, e.g., 45° from a square receiving space 12c defined by the inner periphery of the drive member 12. Fig. 17 illustrates a sixth embodiment of the box end of the spanner 10 that is modified from the fifth embodiment of Fig. 16, wherein only one of the triangular grooves 16 includes a closed first end 161 and an open second end; i.e., each of the other three triangular grooves 16 has an open first end and a second open end. The spanners shown in Figs. 16 and 17 can be used to drive square fasteners.

[0038] Fig. 18 illustrates a seventh embodiment of the box end of the spanner 10, wherein the inner periphery of the drive member 12 is octagonal and includes eight wall faces 13. Each wall face 13 includes a triangular groove 16 having a closed first end 161 and an open second end (not shown). The eight triangular grooves 16 together define an octagonal receiving space 16d that has an angular positional difference of, e.g., 22.5° from an octagonal receiving space 12d defined by the inner periphery of the drive member 12. Fig. 19 illustrates an eighth embodiment of the box end of the spanner 10 that is modified from the seventh embodiment of Fig. 18, wherein only one of the triangular grooves 16 includes a closed first end 161 and an open second end; i.e., each of the other seven triangular grooves 16 has an open first end and a second open end. The spanners shown in Figs. 18 and 19 can be used to drive octagonal fasteners.

[0039] Fig. 20 illustrates a ninth embodiment of the box end of the spanner 10, wherein the box end has no drive member mounted therein. Instead, the box end of the spanner 10 includes an inner periphery having, e.g., six wall faces 13. Each wall face 13 includes a triangular groove 16 having a closed first end 161 and an open second end (not shown). The six triangular grooves 16 together define a hexagonal receiving space 16a that has an angular positional difference of, e.g., 30° from a hexagonal receiving space 12a defined by the inner periphery of the box end of the spanner. Fig. 21 illustrates a tenth embodiment of the box end of the spanner 10 that is modified from the ninth embodiment of Fig. 20, wherein only one of the

triangular grooves 16 includes a closed first end 161 and an open second end; i.e., each of the other five triangular grooves 16 has an open first end and a second open end. The spanners shown in Figs. 20 and 21 can be used to drive hexagonal fasteners.

[0040] According to the above descriptions, it is appreciated that the spanners in accordance with the present invention can be used in three different manners in response to different needs.

[0041] Although the invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and variations can be made without departing from the scope of the invention as hereinafter claimed.